



MARYLAND DEPARTMENT OF TRANSPORTATION

ON-ROAD INVENTORY DEVELOPMENT PROCESS

Scientific and Technical Work Group of the Maryland Commission on Climate Change

June 21, 2017

INVENTORY & FORECAST PROCESSES

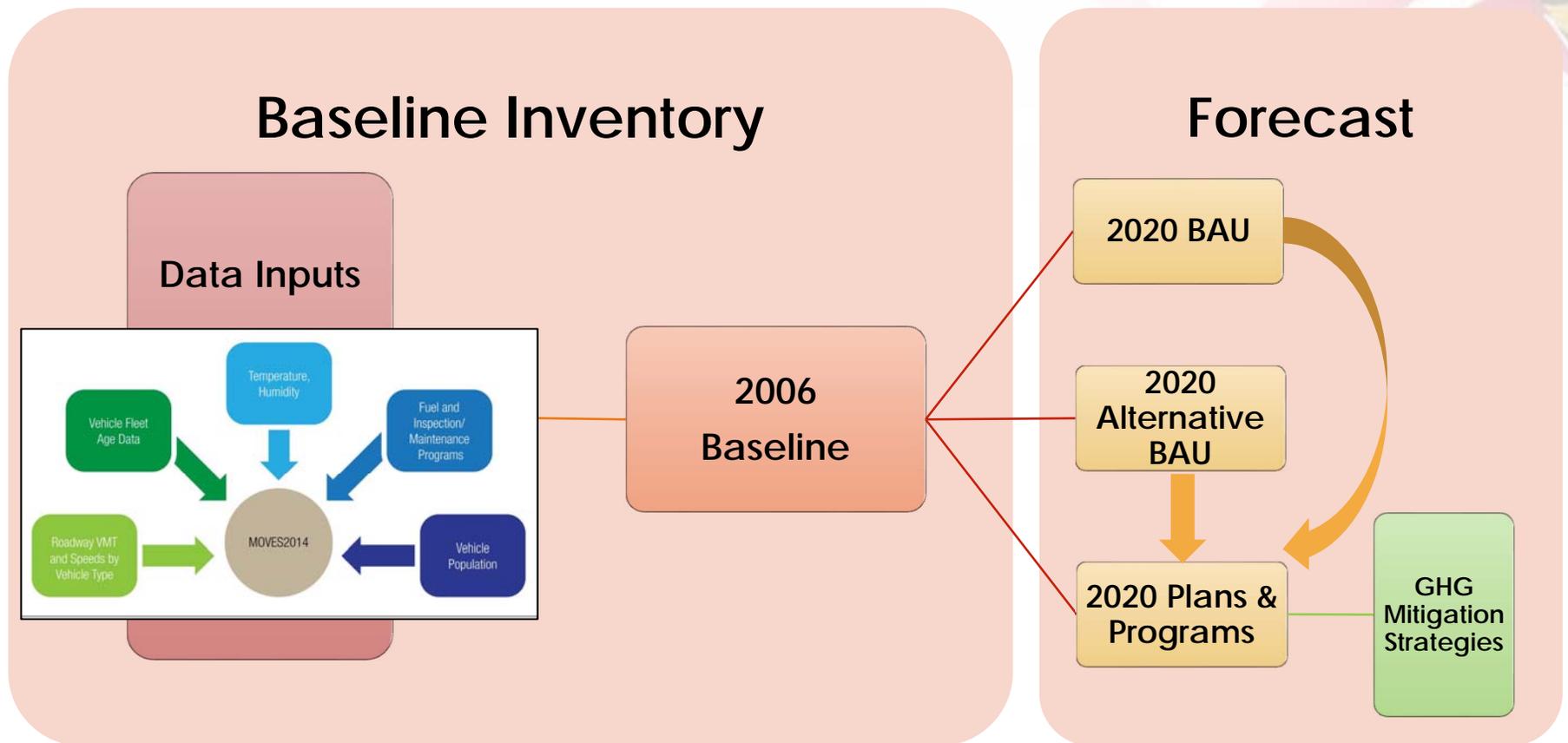
On-Road Mobile Transportation Sources



"BOTTOM UP" APPROACH

1. VMT based inventory using Statewide on-road modeling approach with MOVES2014
2. Same process used for Statewide Emissions Inventories, State Implementation Plans (SIP) and Transportation Conformity
3. **Includes robust forecasting process**
 - Based on SHA VMT reporting, State and MPO travel demand models
 - Incorporates latest planning assumptions and federal vehicle standards
 - Consistent approach supports 2006 baseline and 2020 on-road GHG inventories, and the 2030 forecast and scenarios

INVENTORY & FORECAST PROCESS OVERVIEW



INVENTORY & FORECAST APPROACH DETAILS

- Developed in consultation with MDE and consistent with EPA guidance
- Uses EPA emissions model, Motor Vehicle Emissions Simulator (MOVES2014)
- Incorporates:
 - Technology & Fuel Standards (MD Clean Car & Federal)
 - **Medium/heavy duty vehicle greenhouse gas standards for MY 2014-2018**
 - **Light duty greenhouse gas standards for MY 2017-2025**
 - **Tier 3 vehicle and fuel standards for MY 2017-2025**
 - Maryland on-road fleet data
 - Observed VMT and forecasted VMT associated with MPO cooperative forecasting programs and trend analysis

LAND USE & SOCIOECONOMICS

- **MPO Cooperative Forecasting Process**

- Local governments collaborate to adopt region-wide and neighborhood level socioeconomic forecasts
- Staff use econometric tools and other analysis to supplement local data
- Forecasts are a primary input into regional travel demand models, and are part of the Federally-required regional transportation planning process

**Together the BMC and COG travel models cover
12 counties and 73% of Maryland's population**

CURRENT FORECAST POPULATION

Most Recent BMC and MWCOG forecasts

Population	2015	2020	2030	2040
BRTB - Round 8B (Adopted 8/2016)				
Anne Arundel County	559,619	580,007	606,689	628,048
Baltimore City	633,281	641,128	656,974	667,677
Baltimore County	827,063	834,292	863,004	885,783
Carroll County	170,549	175,900	183,258	189,574
Harford County	251,991	258,668	273,127	291,089
Howard County	311,168	337,051	363,674	371,621
Queen Anne's County	23,189	24,785	27,897	30,391
COG - Round 9 (Adopted 11/2016)				
Montgomery County	1,015,273	1,052,023	1,128,823	1,197,131
Calvert County	91,650	95,600	100,200	101,450
Charles County	150,781	167,036	194,671	218,575
Frederick County	246,499	267,782	303,583	332,151
St. Mary's County	113,899	125,149	148,749	163,349

VMT TRENDS

- Multiple trends:
 - **1990 – 2006**
(high-growth)
 - **1990 – 2013**
(mid-growth)
 - **Trend+Forecast**
(low-growth, combo of MPO data and mid-growth trend)

ANNUAL NUMBER OF VEHICLE MILES TRAVELED (VMT) AND VMT PER CAPITA



Source: MDOT 2017 Annual Attainment Report

VMT PROJECTIONS

- Historic trend and current-year data from SHA.
- Three 2020 VMT scenarios:

- 1. BAU – 1.8% AGR**
based on 1990-2006 VMT growth trend
- 2. Adj. BAU – 1.1% AGR**
based on 1990-2013 VMT growth trend
- 3. Plans and Programs – 0.5% AGR** based on trend and forecasts

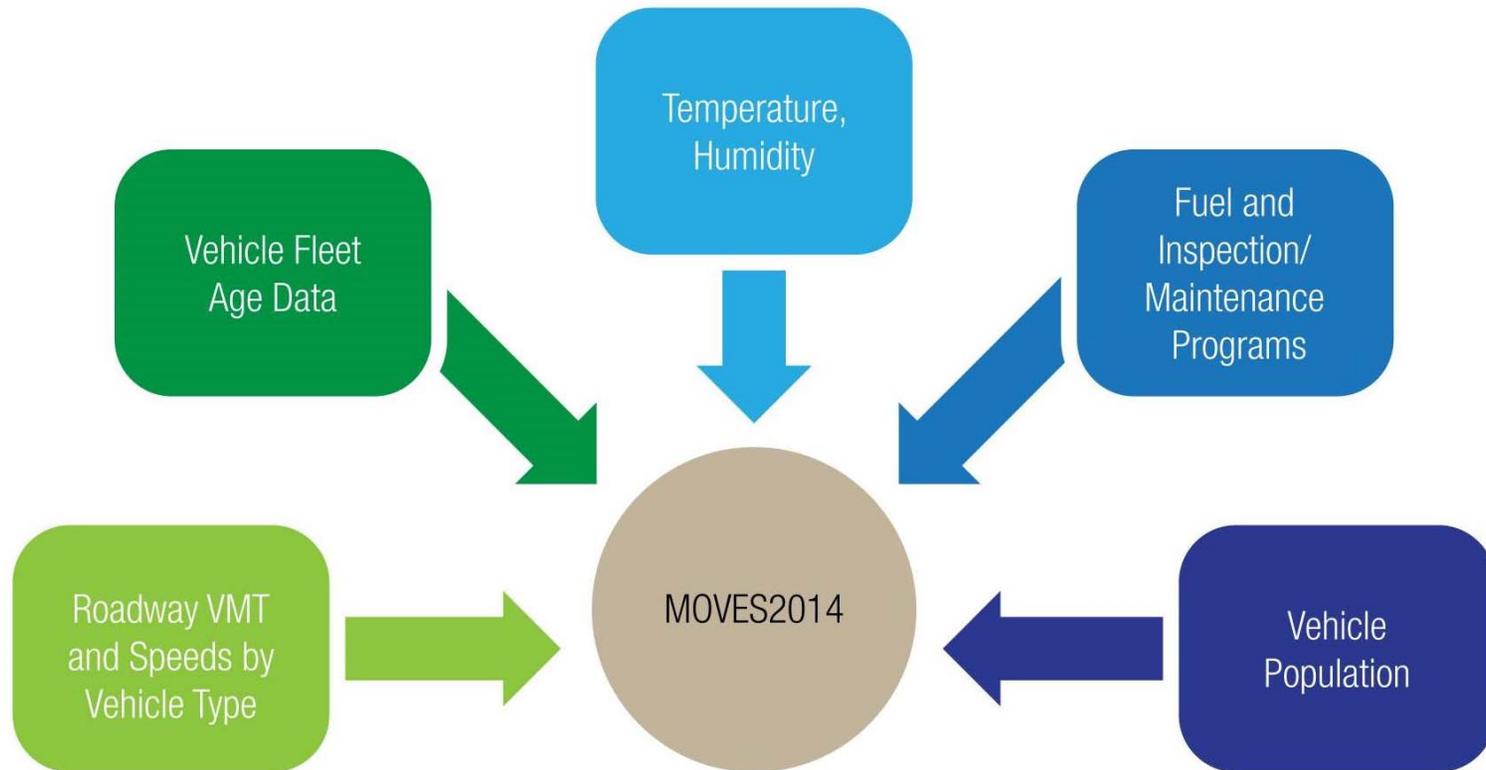
Table 4.1 – Maryland VMT Forecasts and Annual Growth Rates

County	2020 BAU (1990-2006 HPMS)	2020 Adjusted-BAU (1990-2013 HPMS)	MPO Modeling (Plans/Programs/Adopted Land Use)
Allegany	1.3%	0.7%	0.7%
Anne Arundel	2.0%	1.2%	0.4% (BMC)
Baltimore	1.3%	0.9%	-0.3% (BMC)
Calvert	2.5%	1.6%	0.9% (MWCOG)
Caroline	1.3%	0.7%	0.7%
Carroll	1.9%	1.1%	1.5% (BMC)
Cecil	2.4%	1.9%	2.0% (WILMAPCO)
Charles	2.2%	1.3%	0.9% (MWCOG)
Dorchester	0.9%	0.2%	0.2%
Frederick	2.5%	1.6%	0.8% (MWCOG)
Garrett	1.4%	0.6%	0.6%
Harford	1.9%	1.5%	0.0% (BMC)
Howard	3.2%	2.3%	2.2% (BMC)
Kent	0.5%	-0.6%	-0.6%
Montgomery	1.6%	0.9%	0.6% (MWCOG)
Prince George's	1.7%	1.1%	0.6% (MWCOG)
Queen Anne's	2.2%	1.1%	1.1%
Saint Mary's	2.1%	1.4%	1.1% (MWCOG)
Somerset	0.9%	0.0%	0.0%
Talbot	1.8%	1.0%	1.0%
Washington	2.1%	1.1%	0.2% (HEPMPO)
Wicomico	1.6%	1.0%	1.0% (SWMPO)
Worcester	1.4%	1.1%	1.1%
Baltimore City	0.8%	0.2%	-1.2% (BMC)
Statewide	1.8%	1.1%	0.5%

INVENTORY & FORECAST EMISSIONS MODELING

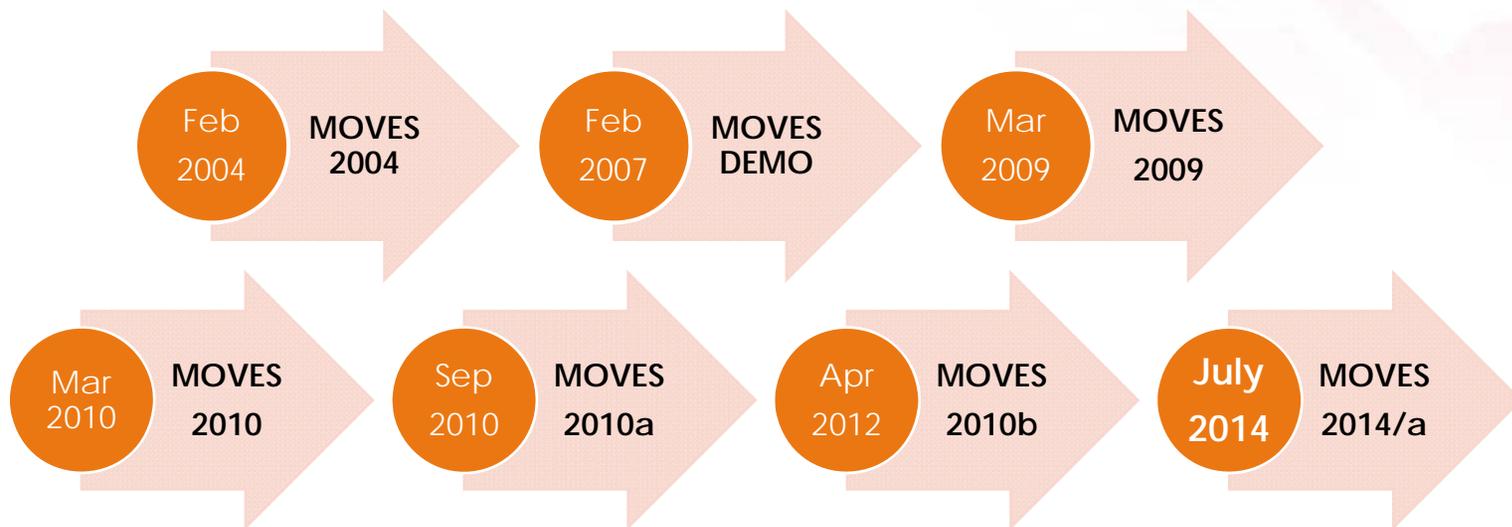
Local Planning Assumptions:

- Minimum every 5-Years
- Every three years in conjunction with NEI / SHA traffic / MVA registration / MDE environmental data



EPA MODEL UPDATES

- EPA Approved Emissions Models - Motor Vehicle Emission Simulator (MOVES)



TRANSPORTATION TECHNOLOGIES

Model Years	Program	Ave Fleet Standard
2008-2010	CAFE	34 mpg by 2020 (LD)
2011	Maryland Clean Car	CA Std w/ ZEV Mandate
2012-2016	Phase I – National Program	34.1 mpg by 2016 (LD)
2017-2025	Phase II – National Program	54.5 mpg by 2025 (LD)
2014-2018	Phase I – MD/HD Truck FE Standard	Multiple benefits
2018-2027	Phase II – MD/HD Truck FE Standard*	Not included in MOVES
2017>	Tier3 Vehicle and Fuel Standards	Lower sulfur content – 10 ppm

**Final Rule – August 2016*

EMISSIONS MODELING DETAILS

- MDOT/MDE implemented Emissions Process
 - Customized software
 - Statewide analysis tool
 - MPO consistency
 - MWCOCG independent
- MDOT maintains and provides technical support
 - MDE process
 - BMC process
 - WILMAPCO and HEPMPO
- Includes robust QA process
- Approved through Interagency Consultation Process

SAMPLE EMISSIONS OUTPUT

MOVES Source Type	MOVES Source TypeID	Statewide Annual CO2e Emission (MMT/Yr)	Statewide Annual VMT
Motorcycle	11	0.11	291,189,158
Passenger Car	21	10.65	27,778,908,896
Passenger Truck	31	9.43	17,820,408,669
Light Commercial Truck	32	3.14	5,932,868,977
Intercity Bus	41	0.12	71,798,583
Transit Bus	42	0.05	35,705,714
School Bus	43	0.08	86,447,378
Refuse Truck	51	0.12	67,026,573
Single Unit Short-haul Truck	52	1.57	1,514,980,269
Single Unit Long-haul Truck	53	0.20	208,564,943
Motor Home	54	0.04	40,814,323
Combination Short-haul Truck	61	2.38	1,320,083,558
Combination Long-haul Truck	62	2.80	1,449,245,819
Light Duty	11~32	23.34	51,823,375,699
Heavy Duty	51~62	7.12	4,600,715,486
Transit Bus	42	0.05	35,705,714
School Bus	43	0.08	86,447,378
All Source Types		30.72	56,618,042,860

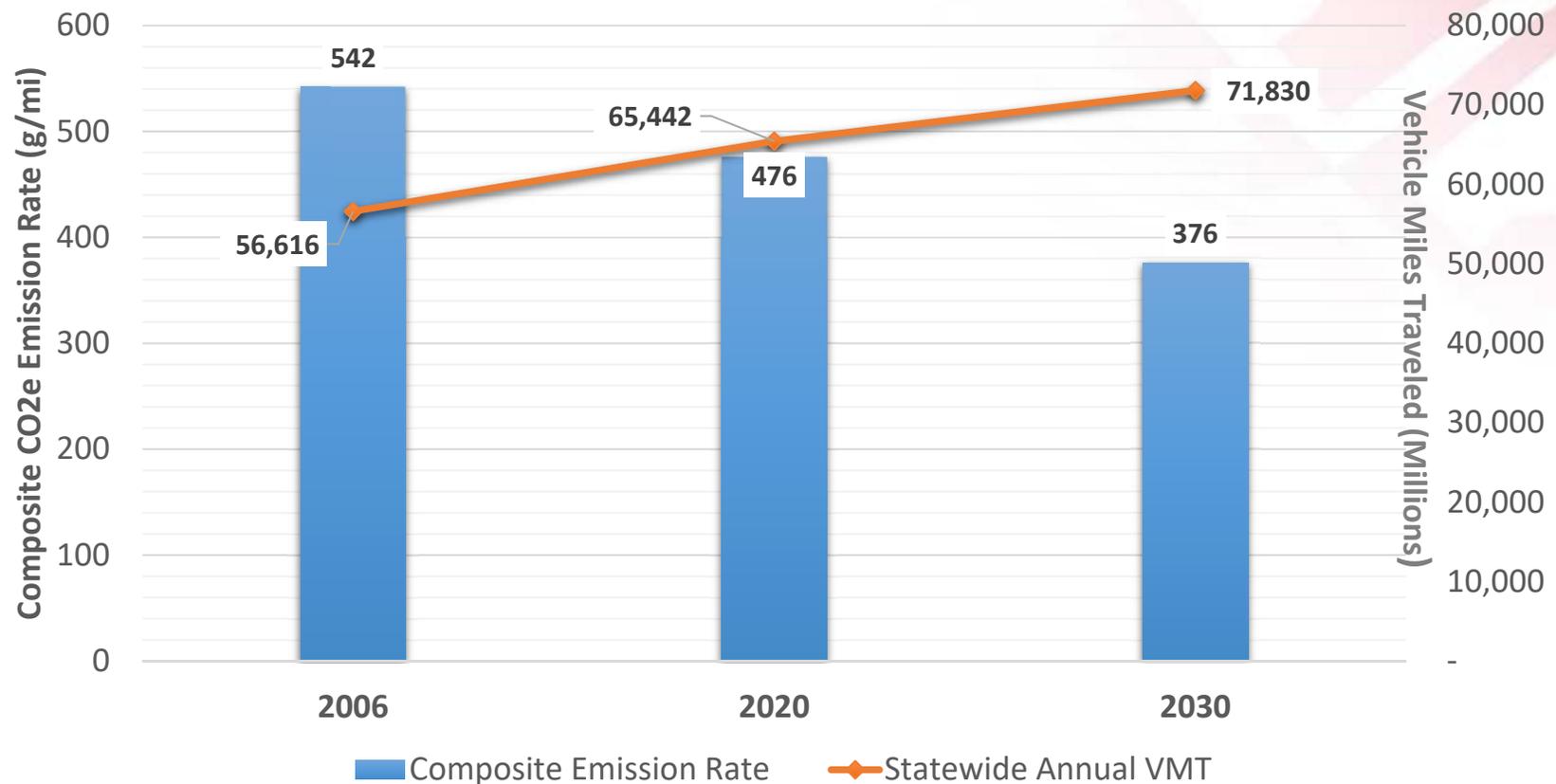
TRANSPORTATION TRENDS

Considerations Through 2030



TRENDS TO 2030

Emission Rate v. Vehicle Miles Traveled (VMT)



EMISSION RATES

2006 composite emission rate
(VMT weighted) = 542 g/mi
1 mmt CO₂e = 1.84 billion VMT

BAU

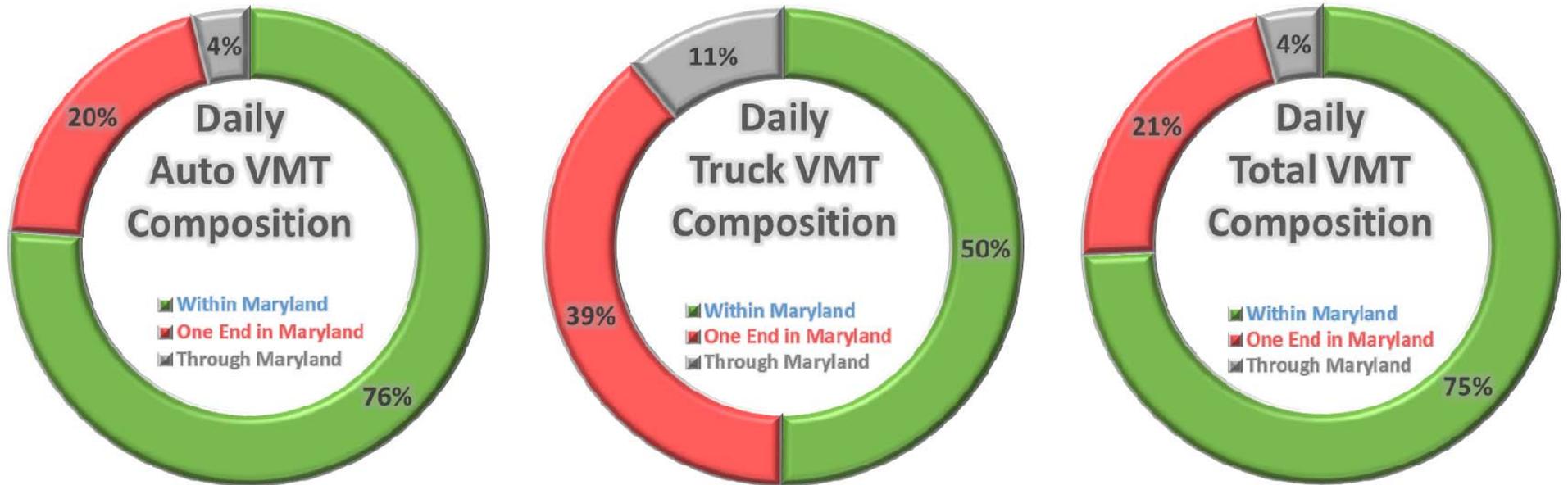
2020 composite emission rate
(VMT weighted) = 476 g/mi
1 mmt CO₂e = 2.10 billion VMT

Adj. BAU
(technology
baseline)

2030 composite emission rate
(VMT weighted) = 376 g/mi
1 mmt CO₂e = 2.66 billion VMT

1 mmtCO₂e reduction = 3.7% Reduction in VMT in 2030

MARYLAND THRU TRAFFIC



Source – SHA Maryland Statewide Travel Model (2015)

LIGHT DUTY FLEET TURNOVER

Light Duty Vehicle Distribution by Model Year* (Compared to Light Duty Vehicles Total)		
Model Year Group	2020	2030
2026 and Later	0.0%	31.2%
2017-2025	22.8%	51.2%
2011-2016	43.5%	13.3%
2010 and Older	33.7%	4.3%
Total	100.0%	100.0%

**Fleet turnover calculated for a sample MD county*

HEAVY DUTY FLEET TURNOVER

Heavy Duty Vehicle Distribution by Model Year* (Compared to Heavy Duty Vehicles Total)		
Model Year Group	2020	2030
2028 and Later	0.0%	11.2%
2019-2027	11.1%	44.2%
2014-2018	24.8%	14.3%
2013 and Older	64.1%	30.3%
Total	100.0%	100.0%

**Fleet turnover calculated for a sample MD county*

NEXT STEPS

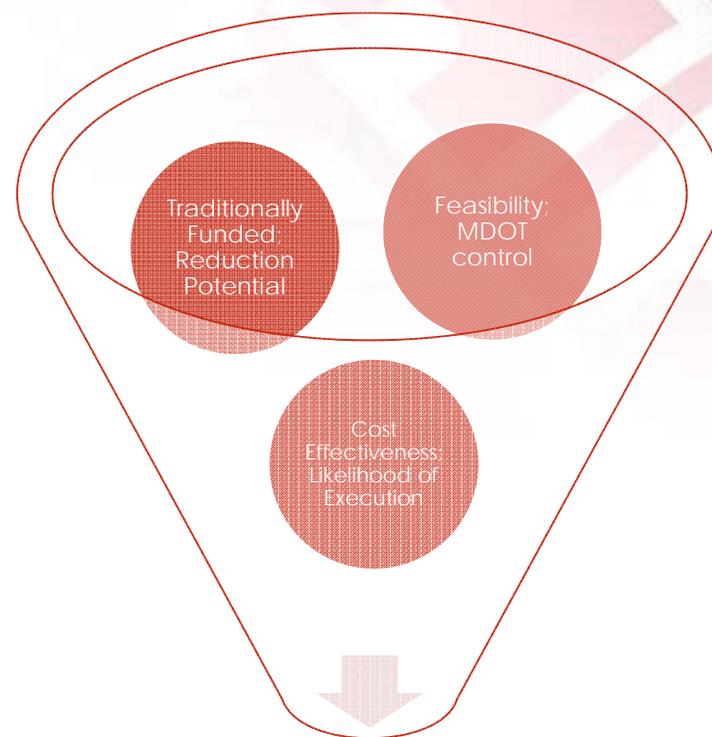


CHALLENGES

- Funding – Constraints & Opportunities
- Land use planning & controls at local jurisdiction level
- Increasing impact of M/HD trucks
- Cost effective strategies relative to technology
- Infrastructure / manufacturer support for electric and autonomous Vehicles
- MDOT / State role v. private role
- Removing barriers (e.g. role as a facilitator)
 - Groundbreaking technologies
 - Research / Regulations
 - Changing Social Norms

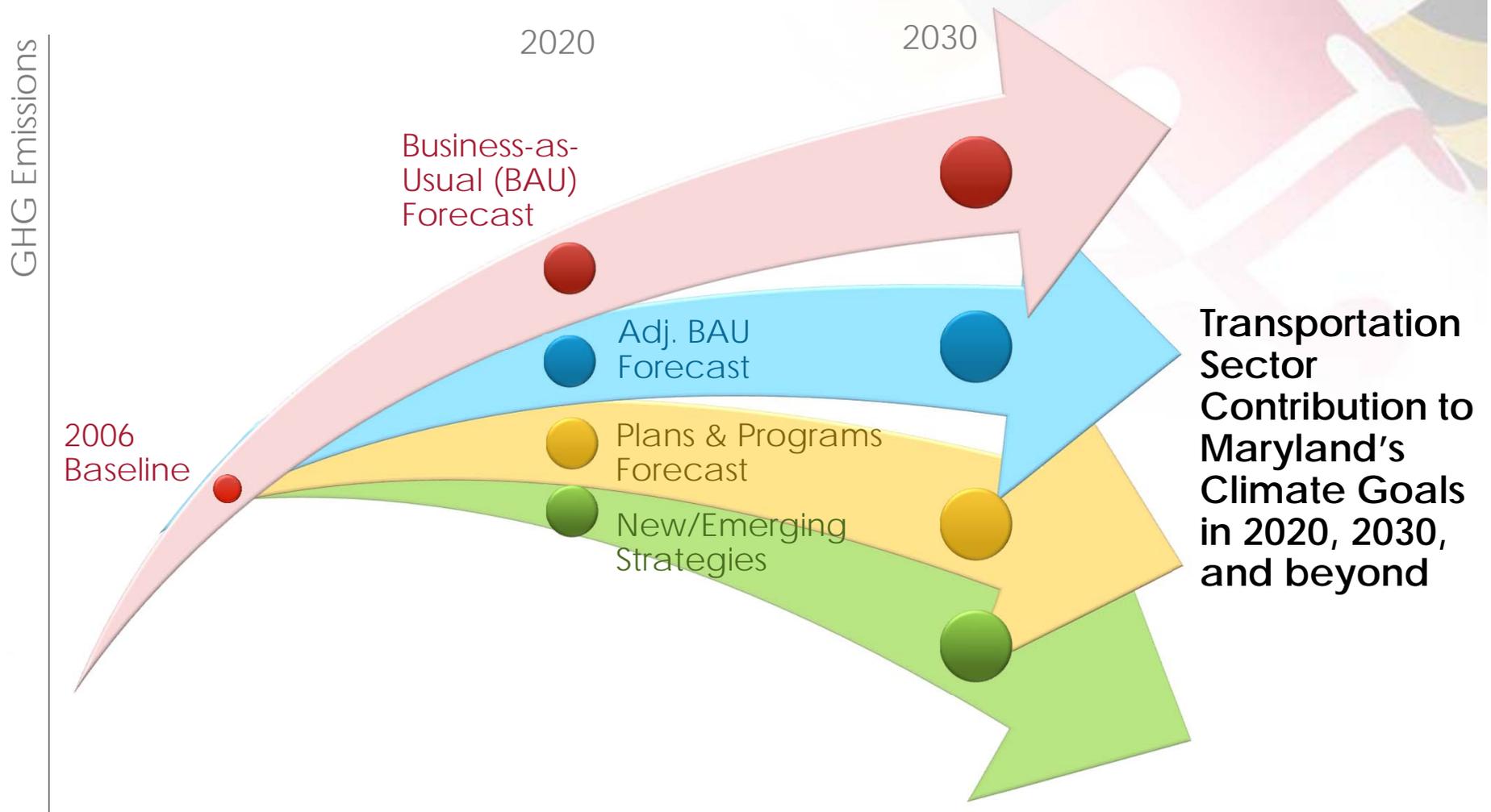
STRATEGY EVALUATION

- Universe of strategies – national and best practice review
- Researching strategies in addition to what's included in plans and programs
- Strategies represent “full” scope of possibilities by 2020 and 2030
- Include traditional capacity and operational strategies, along with technology and behavioral strategies or trends
- Off-model (spreadsheet-based) analyses with inputs from MOVES and other best practice tools/sources



Estimated Strategies

INVENTORY & FORECAST PROCESS RECAP



NEXT STEPS TOWARD 2030

GGRA – 2018 Draft Plan Opportunities

- Stakeholder input into strategy selection and evaluation
- Strategy estimation process enrichment to include scope for estimating synergies of strategy bundles
- Considerations for cross-sectoral consistency in assumptions
- Continued evaluation of best available state-wide inputs to emission modeling process including areas not covered by MPO travel models
- Estimation of strategy co-benefits [EJ, Public Health, other pollutants, etc.]

QUESTIONS?

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MDOT Planning Documents: www.mdot.maryland.gov

MDOT 2015 Greenhouse Gas Reduction Plan

http://www.mdot.maryland.gov/newMDOT/Planning/Environmental/Documents/Greenhouse_Gas_Reduction_Plan_rev.pdf